PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04R 9/06, 9/02, 1/02, 7/06 — A1

(11) International Publication Number: WO 97/09858

(43) International Publication Date: 13 March 1997 (13.03.97)

(21) International Application Number: PCT/GB96/02148

(22) International Filing Date: 2 September 1996 (02.09.96)

(30) Priority Data:

9517918.0	2 September 1995 (02.09.95)	GB
9522281.6	31 October 1995 (31.10.95)	GB
9606836.6	30 March 1996 (30.03.96)	GB

(71) Applicant *(for all designated States except US)*: VERITY GROUP PLC [GB/GB]; Stonehill, Huntingdon, Cambridgeshire PE18 6ED (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: AZIMA, Henry [CA/GB]; 3 Southacre Close, Chaucer Road, Cambridge CB2 2TT (GB). COLLOMS, Martin [GB/GB]; 22 Burgess Hill, London NW2 2DA (GB). HARRIS, Neil [GB/GB]; 9 Davey Crescent, Great Shelford, Cambridge CB2 5JF (GB).

(74) Agent: MAGUIRE & CO.; 5 Crown Street, St. Ives, Cambridgeshire PE17 4EB (GB).

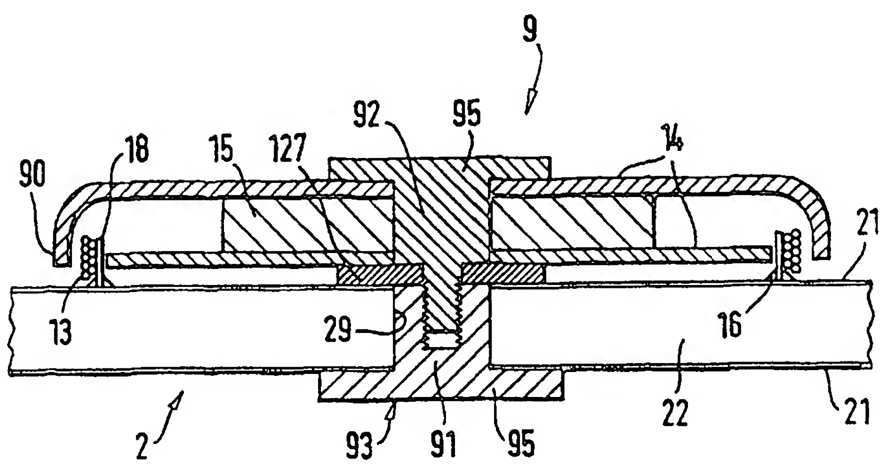
(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: VIBRATION TRANSDUCERS



(57) Abstract

A vibration transducer (9) to vibrate a member (2) having a face, characterised by a motor coil assembly having a coil (13) rigidly fixed to a tubular member (18), the assembly being adapted to be fixed to the said face of the member, and by a magnet assembly (15) comprising opposed disc-like pole pieces, the periphery of one of which pole pieces is arranged to be disposed with and adjacent to the motor coil assembly, and the periphery of the other of which pole pieces is formed with a surround flange (90) adapted to surrounding and to be disposed adjacent to the motor coil assembly, and characterised in that the magnet assembly is adapted to be secured at its centre to the said member to be vibrated.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgystan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic			SE	Sweden
CG	Congo	KR	Republic of Korea	SG	Singapore
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LR	Liberia	SZ	Swaziland
CS	Czechoslovakia	LT	Lithuania	TD	Chad
CZ	Czech Republic	LU	Luxembourg	TG	Togo
DE	Germany	LV	Latvia	TJ	Tajikistan
DK	Denmark	MC	Monaco	TT	Trinidad and Tobago
EE	Estonia	MD	Republic of Moldova	UA	Ukraine
ES	Spain	MG	Madagascar	UG	Uganda
FI	Finland	ML	Mali	US	United States of America
FR	France	MN	Mongolia	UZ	Uzbekistan
GA	Gabon	MR	Mauritania	VN	Viet Nam

VIBRATION TRANSDUCERS

DESCRIPTION

TECHNICAL FIELD

The invention relates to transducers and more particularly to vibration transducers for loudspeakers comprising panel-form acoustic radiating elements.

BACKGROUND ART

It is known from GB-A-2262861 to suggest a panel-form loudspeaker comprising:-

a resonant multi-mode radiator element being a unitary sandwich panel formed of two skins of material with a spacing core of transverse cellular construction, wherein the panel is such as to have ratio of bending stiffness (B), in all orientations, to the cube power of panel mass per unit surface area (μ) of at least 10;

a mounting means which supports the panel or attaches

to it a supporting body, in a free undamped manner;

and an electro-mechanical drive means coupled to the panel which serves to excite a multi-modal resonance in the radiator panel in response to an electrical input within a working frequency band for the loudspeaker.

DISCLOSURE OF INVENTION

Embodiments of the present invention use members of nature, structure and configuration achievable generally and/or specifically by implementing teachings of our co-pending PCT application no. (our case P.5711) of even date herewith. Such members thus have capability to sustain and propagate input vibrational energy by bending waves in operative area(s) extending transversely of thickness often but not necessarily to edges of the member(s); are configured with or without anisotropy of bending stiffness to have resonant mode vibration components distributed over said area(s) beneficially for acoustic coupling with ambient air; and have predetermined preferential locations or sites within said area for transducer means, particularly operationally active or moving part(s) thereof effective in relation to acoustic vibrational activity in said area(s) and signals, usually electrical, corresponding to acoustic content of such vibrational activity. Uses are envisaged in co-pending International application No. (our file P.5711) of even date herewith for such members as or in "passive" acoustic devices without transducer means, such as for reverberation or for acoustic filtering or for acoustically "voicing" a space or room; and as or in

"active" acoustic devices with transducer means, such as in a remarkably wide range of sources of sound or loudspeakers when supplied with input signals to be converted to said sound, or in such as microphones when exposed to sound to be converted into other signals.

This invention is particularly concerned with active acoustic devices in the form of loudspeakers.

Members as above are herein called distributed mode acoustic radiators and are intended to be characterised as in the above PCT application and/or otherwise as specifically provided herein.

The present invention provides a vibration transducer to vibrate a member having a face, characterised by a motor coil assembly having a coil rigidly fixed to a tubular member, the assembly being adapted to be fixed to the said face of the member, and by a magnet assembly comprising opposed disc-like pole pieces, the periphery of one of which pole pieces is arranged to be disposed with and adjacent to the motor coil assembly, and the periphery of the other of which pole pieces is formed with a surrounding flange adapted to surround and to be disposed adjacent to the motor coil assembly, and characterised in that the magnet assembly is adapted to be secured at its centre to the said member to be vibrated.

The transducer may comprise fixing means to secure the magnet assembly to the member. The fixing means may comprise a fastener adapted to engage in a cavity in the member. The fastener may comprise a spacer for spacing the

peripheries of the pole pieces from the said member.

The vibration transducer may comprise complementary motor coil assemblies and magnet assemblies adapted for mounting on opposed faces of the said member, and means tying the centres of the magnet assemblies together for push/pull operation. In such an arrangement the fastener may have heads at opposite ends and adapted to engage the respective magnet assemblies, the fastener comprising a pair of interengaging screw-threaded portions, and having spacer means adapted for disposition adjacent to the fastener and adapted for sandwiching between the respective magnet assemblies and the opposed faces of the said member.

From another aspect the invention is a loudspeaker characterised by a distributed mode acoustic radiator and by a transducer as described above coupled to vibrate the radiator to cause it to resonate.

BRIEF DESCRIPTION OF DRAWINGS

The invention is diagrammatically illustrated, by way of example, in the accompanying drawings, in which:-

Figure 1 is a diagram showing a distributed-mode loudspeaker as described and claimed in our co-pending International application No... (our case P.5711);

Figure 2*a* is a partial section on the line A-A of Figure 1;

Figure 2*b* is an enlarged cross-section through a distributed mode radiator of the kind shown in Figure 2*a* and showing two alternative constructions;

Figure 3 is a diagram of a first embodiment of

transducer according to the present invention, and

Figure 4 is a diagram a second embodiment of transducer according to the present invention;

BEST MODES FOR CARRYING OUT THE INVENTION

Referring to Figure 1 of the drawings, there is shown a panel-form loudspeaker (81) of the kind described and claimed in our co-pending International application No. (our case P.5711) of even date herewith comprising a rectangular frame (1) carrying a resilient suspension (3) round its inner periphery which supports a distributed mode sound radiating panel (2). A transducer (9) e.g as described in detail with reference to our co-pending International applications Nos. (our cases P.5683/4/5) of even date herewith, is mounted wholly and exclusively on or in the panel (2) at a predetermined location defined by dimensions x and y, the position of which location is calculated as described in our co-pending International application No. (our case P.5711) of even date herewith, to launch bending waves into the panel to cause the panel to resonate to radiate an acoustic output.

The transducer (9) is driven by a signal amplifier (10), e.g. an audio amplifier, connected to the transducer by conductors (28). Amplifier loading and power requirements can be entirely normal, similar to conventional cone type speakers, sensitivity being of the order of 86 - 88dB/watt under room loaded conditions. Amplifier load impedance is largely resistive at 6 ohms, power handling 20-80 watts. Where the panel core and/or

skins are of metal, they may be made to act as a heat sink for the transducer to remove heat from the motor coil of the transducer and thus improve power handling.

Figures 2a and 2b are partial typical cross-sections through the loudspeaker (81) of Figure 1. Figure 2a shows that the frame (1), surround (3) and panel (2) are connected together by respective adhesive-bonded joints (20). Suitable materials for the frame include lightweight framing, e.g. picture framing of extruded metal e.g. aluminium alloy or plastics. Suitable surround materials include resilient materials such as foam rubber and foam plastics. Suitable adhesives for the joints (20) include epoxy, acrylic and cyano-acrylate etc. adhesives.

Figure 2b illustrates, to an enlarged scale, that the panel (2) is a rigid lightweight panel having a core (22) e.g. of a rigid plastics foam (97) e.g. cross linked polyvinylchloride or a cellular matrix (98) i.e. a honeycomb matrix of metal foil, plastics or the like, with the cells extending transversely to the plane of the panel, and enclosed by opposed skins (21) e.g. of paper, card, plastics or metal foil or sheet. Where the skins are of plastics, they may be reinforced with fibres e.g. of carbon, glass, Kevlar (RTM) or the like in a manner known *per se* to increase their modulus.

Envisaged skin layer materials and reinforcements thus include carbon, glass, Kevlar (RTM), Nomex (RTM) i.e. aramid etc. fibres in various lays and weaves, as well as paper, bonded paper laminates, melamine, and various

synthetic plastics films of high modulus, such as Mylar (RTM), Kaptan (RTM), polycarbonate, phenolic, polyester or related plastics, and fibre reinforced plastics, etc. and metal sheet or foil. Investigation of the Vectra grade of liquid crystal polymer thermoplastics shows that they may be useful for the injection moulding of ultra thin skins or shells of smaller size, say up to around 30cm diameter. This material self forms an orientated crystal structure in the direction of injection, a preferred orientation for the good propagation of treble energy from the driving point to the panel perimeter.

Additional such moulding for this and other thermoplastics allows for the mould tooling to carry location and registration features such as grooves or rings for the accurate location of transducer parts e.g. the motor coil, and the magnet suspension. Additional with some weaker core materials it is calculated that it would be advantageous to increase the skin thickness locally e.g. in an area or annulus up to 150% of the transducer diameter, to reinforce that area and beneficially couple vibration energy into the panel. High frequency response will be improved with the softer foam materials by this means.

Envisaged core layer materials include fabricated honeycombs or corrugations of aluminium alloy sheet or foil, or Kevlar (RTM), Nomex (RTM), plain or bonded papers, and various synthetic plastics films, as well as expanded or foamed plastics or pulp materials, even aerogel metals

if of suitably low density. Some suitable core layer materials effectively exhibit usable self-skinning in their manufacture and/or otherwise have enough inherent stiffness for use without lamination between skin layers. A high performance cellular core material is known under the trade name 'Rohacell' which may be suitable as a radiator panel and which is without skins. In practical terms, the aim is for an overall lightness and stiffness suited to a particular purpose, specifically including optimising contributions from core and skin layers and transitions between them.

Several of the preferred formulations for the panel employ metal and metal alloy skins, or alternatively a carbon fibre reinforcement. Both of these, and also designs with an alloy Aerogel or metal honeycomb core, will have substantial radio frequency screening properties which should be important in several EMC applications. Conventional panel or cone type speakers have no inherent EMC screening capability.

In addition the preferred form of piezo and electro dynamic transducers have negligible electromagnetic radiation or stray magnet fields. Conventional speakers have a large magnetic field, up to 1 metre distant unless specific compensation counter measures are taken.

Where it is important to maintain the screening in an application, electrical connection can be made to the conductive parts of an appropriate DML panel or an electrically conductive foam or similar interface may be

used for the edge mounting.

The suspension (3) may damp the edges of the panel (2) to prevent excessive edge movement of the panel. Additionally or alternatively, further damping may be applied, e.g. as patches, bonded to the panel in selected positions to damp excessive movement to distribute resonance equally over the panel. The patches may be of bitumen-based material, as commonly used in conventional loudspeaker enclosures or may be of a resilient or rigid polymeric sheet material. Some materials, notably paper and card, and some cores may be self-damping. Where desired, the damping may be increased in the construction of the panels by employing resiliently setting, rather than rigid setting adhesives.

Effective said selective damping includes specific application to the panel including its sheet material of means permanently associated therewith. Edges and corners can be particularly significant for dominant and less dispersed low frequency vibration modes of panels hereof. Edge-wise fixing of damping means can usefully lead to a panel with its said sheet material fully framed, though their corners can often be relatively free, say for desired extension to lower frequency operation. Attachment can be by adhesive or self-adhesive materials. Other forms of useful damping, particularly in terms of more subtle effects and/or mid- and higher frequencies can be by way of suitable mass or masses affixed to the sheet material at predetermined effective medial localised positions of said

area.

An acoustic panel as described above is bi-directional. The sound energy from the back is not strongly phase related to that from the front. Consequently there is the benefit of overall summation of acoustic power in the room, sound energy of uniform frequency distribution, reduced reflective and standing wave effects and with the advantage of superior reproduction of the natural space and ambience in the reproduced sound recordings.

While the radiation from the acoustic panel is largely non-directional, the percentage of phase related information increases off axis. For improved focus for the phantom stereo image, placement of the speakers, like pictures, at the usual standing person height, confers the benefit of a moderate off-axis placement for the normally seated listener optimising the stereo effect. Likewise the triangular left/right geometry with respect to the listener provides a further angular component. Good stereo is thus obtainable.

There is a further advantage for a group of listeners compared with conventional speaker reproduction. The intrinsically dispersed nature of acoustic panel sound radiation gives it a sound volume which does not obey the inverse square law for distance for an equivalent point source. Because the intensity fall-off with distance is much less than predicted by inverse square law then consequently for off-centre and poorly placed listeners the

intensity field for the panel speaker promotes a superior stereo effect compared to conventional speakers. This is because the off-centre placed listener does not suffer the doubled problem due to proximity to the nearer speaker; firstly the excessive increase in loudness from the nearer speaker, and then the corresponding decrease in loudness from the further loudspeaker.

There is also the advantage of a flat, lightweight panel-form speaker, visually attractive, of good sound quality and requiring only one transducer and no crossover for a full range sound from each panel diaphragm.

Figure 3 illustrates an embodiment of transducer (9) for launching bending waves into a rigid lightweight distributed mode radiator panel (2), e.g. of the kind shown in Figures 1 and 2 comprising a core (22) enclosed by opposed skins (21), to cause the panel to resonate.

The transducer comprises a coil (13) rigidly fixed, e.g. by means of an adhesive, on the outside of a coil former (18) which is rigidly bonded to a surface skin (21) of the radiator panel (2), e.g. by means of an epoxy adhesive bond (16). A magnet (15) is enclosed by a pair of poles (14), one of which is disc-like and is disposed with its periphery close to the interior of the coil former (18), and the other of which has a peripheral flange (90) arranged to surround the coil (13).

The magnet assembly including the magnet (15) and poles (14) is mounted on the panel (2) by means of a fixing (93), e.g. of metal or hard plastics, which passes through

a cavity (29) extending through the panel (2). The fixing (93) comprises a complementary pair of threaded members (91,92) each having heads (95), one of which heads bears against an outer face of the transducer (9) and the other of which heads bear against a face of the panel (2) on the side of the panel opposite to that on which the transducer is mounted. A spacer (127) is trapped between the transducer (9) and the panel (2) to space the transducer from the panel.

The transducer (9) of Figure 3 operates by locally resiliently bending the panel between the fixing (93) and the former (18) when an acoustic signal is applied to the transducer to launch bending waves into the panel to cause it to resonate.

The transducer arrangement (9) of Figure 4 is similar to that described in Figure 3, except that in this embodiment the transducer comprises complementary push/pull drivers of the kind shown in Figure 3 disposed on opposite sides of the panel. A fixing member (93) is arranged to pass through an aperture (29) in the panel (2) to tie the two transducers together and to the panel. The fixing member (93) comprises opposed generally complementary parts each formed with a head (95) which are clamped against the axial extremities of the respective pair of transducers (9) to couple the drivers together. The complementary parts of the fixing member (93) are secured together by complementary screw-threaded portions (94,96). The fixing member may be of any suitable material e.g. plastics or

metal.

In this embodiment the transducer device (9) is rigidly clamped to the panel (2) by means of rigid pads (19), e.g. of hard plastics, positioned between the panel and the poles (14) adjacent to the aperture (29), whereby the transducer works to launch bending waves into the panel by local resilient bending of the panel between the pads and the coil former (18).

CLAIMS

1. A vibration transducer to vibrate a member having a face, characterised by a motor coil assembly having a coil rigidly fixed to a tubular member, the motor coil assembly being adapted to be fixed to the said face of the member, and by a magnet assembly comprising opposed disc-like pole pieces, the periphery of one of which pole pieces is arranged to be disposed with and adjacent to the motor coil assembly, and the periphery of the other of which pole pieces is formed with a surrounding flange adapted to surround and to be disposed adjacent to the motor coil assembly, and characterised in that the magnet assembly is adapted to be secured at its centre to the said member to be vibrated.

2. A vibration transducer according to claim 1, characterised by fixing means to secure the magnet assembly to the member.

3. A vibration transducer according to claim 2, characterised in that the fixing means comprises a fastener adapted to engage in a cavity in the member.

4. A vibration transducer according to claim 3, characterised in that the fastener comprises a spacer for spacing the peripheries of the pole pieces from the said member.

5. A vibration transducer according to any preceding claim, characterised by complementary motor coil assemblies and magnet assemblies adapted for mounting on opposed faces of the said member, and by means tying the centres of the

magnet assemblies together for push/pull operation.

6. A vibration transducer according to claim 5, characterised in that the fastener has heads at opposite ends and adapted to engage the respective magnet assemblies, the fastener comprising a pair of interengaging screw-threaded portions, and characterised by spacer means adapted for disposition adjacent to the fastener and adapted for sandwiching between the respective magnet assemblies and the opposed faces of the said member.

7. A loudspeaker characterised by a distributed mode acoustic radiator and by a transducer as claimed in any preceding claim coupled to vibrate the radiator to cause it to resonate.

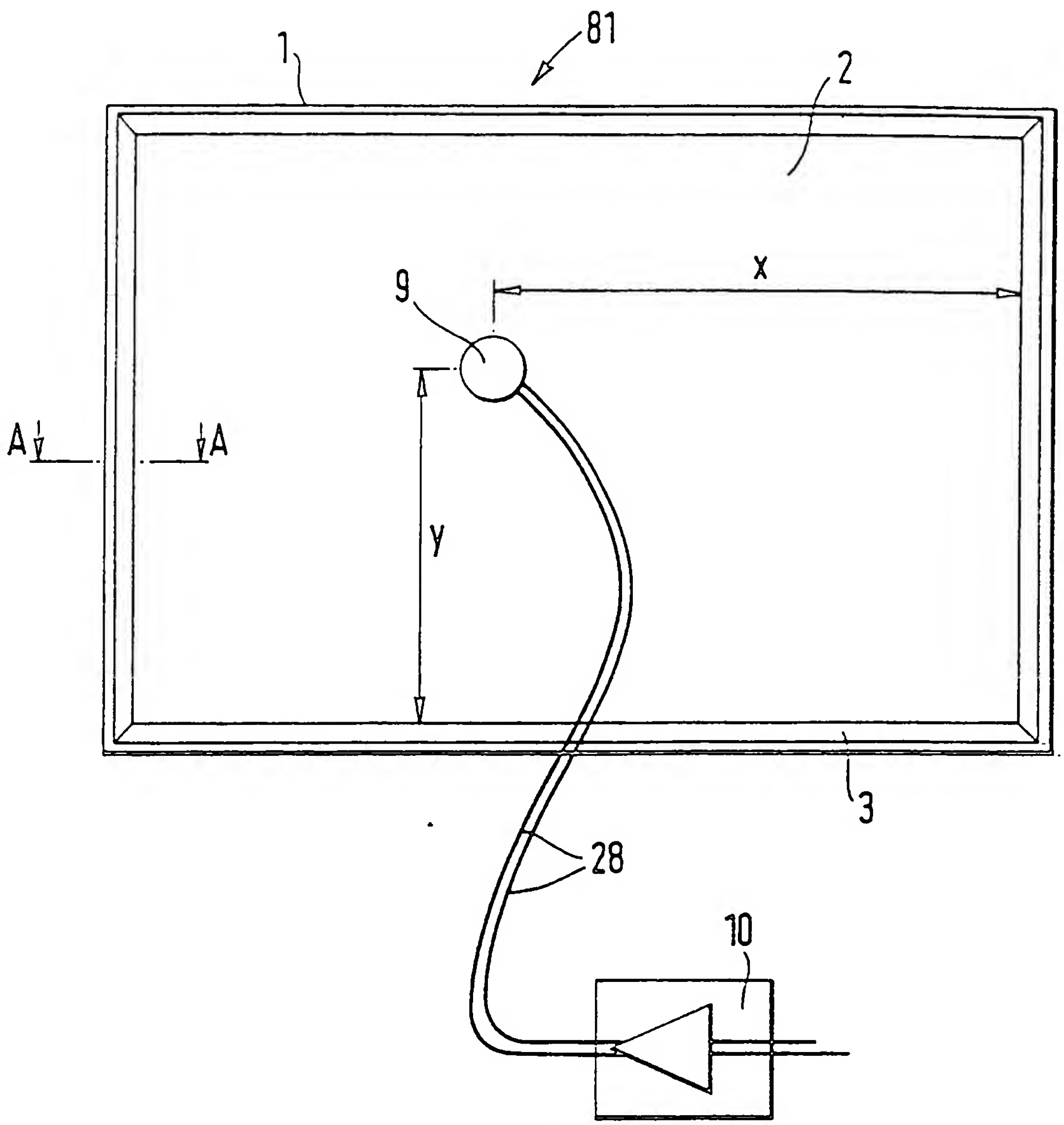


Fig. 1

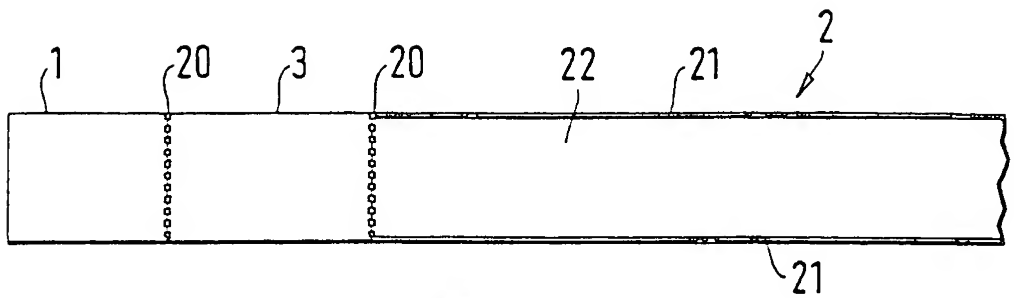


Fig. 2a

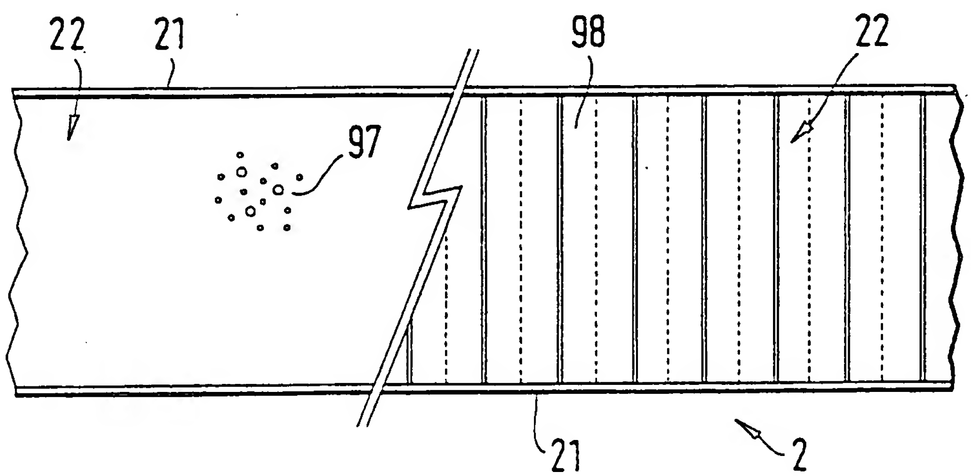


Fig. 2b

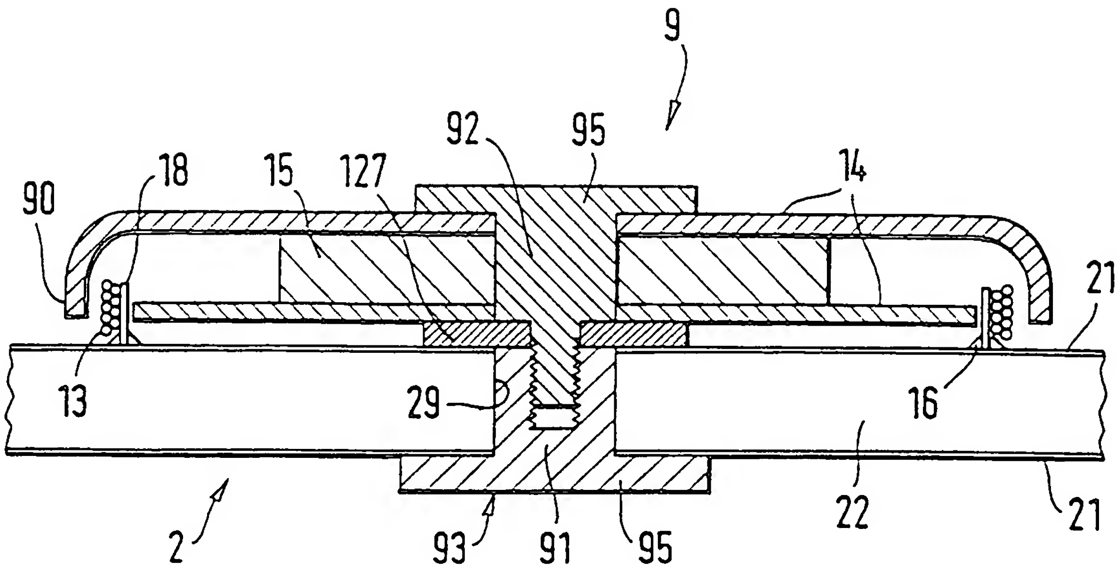


Fig.3

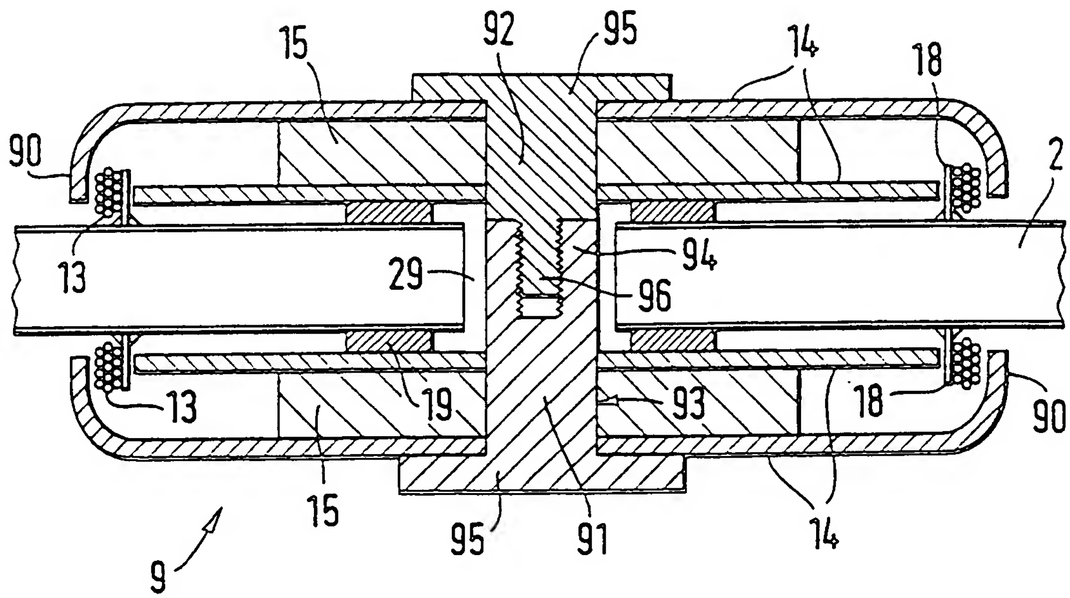


Fig. 4

INTERNATIONAL SEARCH REPORT

Inten nal Application No
PCT/GB 96/02148

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04R9/06 H04R9/02 H04R1/02 H04R7/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 506 117 A (FRESARD) 19 March 1985 see column 2, line 45 - column 3, line 12; figure 4 ---	1,7
Y	US 4 055 732 A (YOSHIMURA ET AL.) 25 October 1977	1,7
A	see column 3, line 30 - line 40; figure 2 ---	2-4
A	US 4 392 027 A (BOCK) 5 July 1983 see column 2, line 1 - line 16; figure 2 ---	1
A	WO 89 00798 A (AVM HESS INC) 26 January 1989 see page 12, line 1 - line 29; figure 10 --- -/--	1

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

3

Date of the actual completion of the international search

18 December 1996

Date of mailing of the international search report

20.01.97

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Gastaldi, G

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Intern. al Application No
PCT/GB 96/02148

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 010, no. 129 (E-403), 14 May 1986 & JP 60 259100 A (YOSHIROU NAKAMATSU), 21 December 1985, see abstract ---	5,6
A	WO 92 03024 A (SECR DEFENCE BRIT) 20 February 1992	1
A	& GB 2 262 861 A (SECR DEFENSE) 30 June 1993 cited in the application see page 5, line 4 - page 6, line 5; figures -----	1

3

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern   nal Application No
PCT/GB 96/02148

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-4506117	19-03-85	CH-A-	645227	14-09-84
		CA-A-	1191937	13-08-85
		EP-A-	0083310	06-07-83
US-A-4055732	25-10-77	JP-C-	999013	30-05-80
		JP-A-	51064916	04-06-76
		JP-B-	54033739	23-10-79
US-A-4392027	05-07-83	DE-A-	2819615	08-11-79
		FR-A-	2425188	30-11-79
		GB-A,B	2020509	14-11-79
WO-A-8900798	26-01-89	US-A-	4914750	03-04-90
WO-A-9203024	20-02-92	GB-A-	2246684	05-02-92
		AT-T-	117155	15-01-95
		DE-D-	69106712	23-02-95
		DE-T-	69106712	08-06-95
		EP-A-	0541646	19-05-93
		GB-A,B	2262861	30-06-93
		JP-T-	5509211	16-12-93